REMARKS

Claims 38 through 53 and 56 through 62 are pending in the present application. Claims 1 through 37 were previously canceled, claims 54 and 55 are canceled by the present amendment, and claims 60 through 62 are newly added.

In section 2 of the Office Action, the Examiner objected to the drawings, alleging that Figs. 3 and 7 contain manually corrected labels. Applicants filed the application with a set of drawings where Figs. 3 and 7 DO NOT include manually corrected labels. However, Applicants simultaneously submitted a preliminary amendment to the drawings, in accordance with USPTO practice, where Figs. 3 and 7 were amended including with manual corrections. Applicants suspect that the version of the drawings to which the Examiner has objected may be those that were submitted with the preliminary amendment. Applicants also recognize that they are still obligated to submit of set of formal drawings, but would prefer to defer such submission until after any substantive issues are resolved. Applicants respectfully submit that this explanation is fully responsive to the objection to the drawings. Accordingly, Applicants request that the Examiner withdraw the objection to the drawings and review the drawings with regard to their substance.

In section 3 of the Office Action, the Examiner objected to the specification for various informalities. Applicants thank the Examiner for making what appears to be a thorough, careful review of the specification. In particular, Applicants thank the Examiner for suggesting that the phrase "numerical aperture" should be used in certain circumstances, and also for suggesting alternatives for several arithmetic equations. With the exception of the Examiner's interpretation of a passage at page 4, line 16, Applicants have amended the specification in accordance with the Examiner's suggestions.

With regard to page 4, line 16, (Applicants believe the Examiner intended to cite page 4, line 15), Applicants wish for the Examiner to note that in the filed of optics, a numerical aperture is understood to be a product of a refractive index and a sine of a half

B

angle, i.e. NA = n sin θ/2. θ/2 is a half angle of a light cone incident on a reticle plane. Since NA ≈ θ/2 is valid, for small values of NA, and in a vacuum with n = 1.0, the numerical aperture is equivalent to the aperture angle. Accordingly, at page 4, line 15, the phrase "square of the aperture angle" does not need to be amended.

Applicants submit that they have responded to all of the issues cited in the Examiner's objection to the specification. As such, Applicants respectfully request that the Examiner withdraw the objection to the specification.

In section 4 of the Office Action, claims 38 and 40 through 42 were rejected under 35 U.S.C. 102(a) and (e) as being anticipated U.S. Patent No. 6,325,514 to Chikara Yamamoto (hereinafter "the Yamamoto (Ch) patent"). The present application contains one independent claim, namely claim 38. Applicants amended claim 38 to clarify a feature of the claimed invention that is neither described nor suggested by the Yamamoto (Ch) patent.

Claim 38 now recites, in relevant part, that "each of said first plurality of raster elements is reflective...." In the Office Action, the Examiner suggested that the Yamamoto (Ch) patent's integrator 11, or equivalently integrator 111, is descriptive of the first plurality of raster elements, as recited in claim 38. Integrator 11 includes a deflection plate 11C, which "deflects the bundles of rays incident thereon to translate or shift them as parallel towards the optical axis LO..." (col. 4, lines 37 - 39) and similarly, integrator 111 "deflects the bundles of rays incident thereon to translate or shift them as parallel toward the optical axis LO..." (col. 6, lines 56 - 58). The translation or shift of rays, as performed by each of integrators 11 and 111, is descriptive of a **refractive** operation, and thus is inconsistent with the first raster elements being **reflective**, as recited in claim 38.

Applicants submit that the Yamamoto (Ch) patent does not anticipate claim 38. Claims 40 through 42 depend from, and inherit the features of, claim 38. Thus, claims 40 through 42 are also not anticipated by the Yamamoto (Ch) patent. Applicants

B

respectfully request reconsideration and withdrawal of the section 102(a) and (e) rejection of claims 38 and 40 through 42.

In section 9 of the Office Action, claims 43 and 44 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Yamamoto (Ch) patent in view of Japanese Patent Publication No. 11044920 A to Yamamoto et al. (hereinafter "the Yamamoto et al. publication").

Claims 43 and 44 depend from claim 38, and thus, through inheritance of the features of claim 38, they implicitly recite that "said first plurality of raster elements is reflective..." The Yamamoto et al. publication appears to describe an integrator 11 similar to integrators 11 and 111 of the Yamamoto (Ch) patent. However, neither the Yamamoto (Ch) patent nor the Yamamoto et al. publication, whether considered alone or in combination, describe or suggest a first plurality of raster elements that is reflective. Consequently, the section 103(a) rejection of claims 43 and 44 cannot be sustained. Applicants respectfully request reconsideration and withdrawal of the section 103(a) rejection of claims 43 and 44.

In section 10 of the Office Action, claims 39 and 45 - 47 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Yamamoto (Ch) patent in view of U.S. Patent No. 5,993,010 to Ohzawa et al. (hereinafter "the Ohzawa et al. patent"). The Examiner suggested that in the Ohzawa et al. patent, an array 10 (Fig. 1) or a plurality of lenses 190 (Fig. 14) is described as showing a feature that could be used to modify the integrator 11 or 111 of the Yamamoto (Ch) patent.

Applicants note that in the Ohzawa et al. patent, array 10 is a reflective element, whereas in the Yamamoto (Ch) patent, integrators 11 and 111 are refractive elements. As such, the modification proposed by the Examiner does not appear to be technically feasible. Furthermore, such a modification would necessarily, and impermissibly, change the underlying operation of at least one of the Yamamoto (Ch) patent or the Ohzawa et al. patent. Accordingly, Applicants respectfully submit that array 10 of the Ohzawa et al.

patents cannot be used in combination with integrators 11 and 111 of the Yamamoto (Ch) patent to render the claims of the present application unpatentable under section 103.

Regarding the Examiner's suggestion of using the plurality of lenses 190 of the Ohzawa et al patent to modify the integrators 11 or 111 of the Yamamoto (Ch) patent, Applicants point out that such a combination fails to describe or suggest a first plurality of raster elements that are reflective, as recited in claim 38. As claims 39 and 45 through 47 depend from claim 38, the attempted combination fails to teach all of the elements of the claims.

As the attempted combinations of the Yamamoto (Ch) and Ohzawa et al. patents are either (a) not permissible or (b) deficient in describing or suggesting all of the elements of the claims, Applicants respectfully request reconsideration and withdrawal of the section 103(a) rejection of claim 39 and 45 through 47.

In section 11 of the Office Action, claims 48 through 52, 54 and 55 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Yamamoto (Ch) patent in view of the Ohzawa et al. patent, further in view of the Yamamoto et al. publication. As Applicants explained above, the attempted combination of the Yamamoto (Ch) patent with either of the Ohzawa et al. patent or the Yamamoto et al. publication is either not permissible, or is deficient in describing or suggesting all of the elements of claim 38. Claims 48 through 52, 54 and 55 depend from claim 38, and thus, are patentable over this attempted the combination of references for at least the same reasons as claim 38. Applicants respectfully request reconsideration and withdrawal of the section 103(a) rejection of claims 48 through 52, 54 and 55.

In section 12 of the Office Action, claims 53 and 56 were rejected under 35 U.S.C. 103(a) as being unpatentable over a combination of the Yamamoto (Ch) patent, the Ohzawa et al. patent and the Yamamoto et al. publication, further in view of U.S. Patent No. 6,198,793 B1 to Schultz et al. (hereinafter "the Schultz et al. patent"). Claims 53 and 56 depend from claim 38. Applicants respectfully submit that the refractive nature of

integrators 11 and 111 in the Yamamoto (Ch) patent render this reference unsuitable for use in a rejection of any claim that depends form claim 38. Accordingly, reconsideration and withdrawal of the section 103(a) rejection of claims 53 and 56 is respectfully solicited.

Furthermore, Applicants wish for the Examiner to note that both the Schultz et al. patent and the present application are assigned to the same entity, namely Carl-Zeiss-Stiftung Trading As Carl Zeiss, and that the present application was filed before the Schultz et al. patent issued. As such, pursuant to 35 U.S.C. 103(c), the Schultz et al. patent cannot serve as a basis for a rejection under section 103(a).

In section 13 of the Office Action, claims 57 through 59 were rejected as being unpatentable over the Yamamoto (Ch) patent in view of U.S. Patent No. 6,236,449 B1 to Tanitsu (hereinafter "the Tanitsu patent"). As explained earlier, the refractive integrators 11 and 111 of the Yamamoto (Ch) patent render it unsuitable for use in a rejection of claim 38. Claims 57 through 59 depend from claim 38. Applicants respectfully request reconsideration and withdrawal of the section 103(a) rejection of claims 57 through 59.

Applicants added claims 60, 61 and 62 to capture subject matter, e.g., the structure is in a shape of a pyramid, that was previously recited in claims 43, 48 and 50, respectively. An exemplary embodiment of such a pyramid is shown in Fig. 2. Thus, no new subject matter has been added.

Applicants amended claim 38 to recite a feature that is neither described nor suggested by the art of record. Claims 42, 43, 45, 46, 48 - 51, 56, 58 and 59 are amended to improve their form or to delete language that is not necessary for patentablity, or because subject matter is now recited in another claim. Applicants submit that the amendments do not narrow the meaning of any term of the claims, and as such, the doctrine of equivalents should be available for all of the elements of all of the claims.

B

In view of the foregoing, Applicants respectfully submit that all claims presented in this application patentably distinguish over the prior art. Accordingly, Applicants respectfully request favorable consideration and that this application be passed to allowance.

Respectfully submitted,

October 28, 2002
Date

Charles N.J. Ruggiero, Esq.
Reg. No. 28,468
Attorney for the Applicants
Ohlandt, Greeley, Ruggiero & Perle, L.L.P.
One Landmark Square, 10th Floor
Stamford, CT 06901-2682
Tel: 203-327-4500
Fax: 203-327-6401

VERSION MARKED TO SHOW CHANGES MADE

IN THE SPECIFICATION

Please amend the portions of the Specification identified below to read as indicated herein.

Page 3, paragraph starting at line 26:

If the numerical aperture in the plane of the wafer is in the range $NA_{wafer} = 0.1\text{-}0.25$, then in the case of 4:1 systems ~~an~~, a numerical aperture in the reticle plane of $NA_{reticle} = 0.025\text{-}0.0625$ is needed. If the illumination system is supposed to illuminate this aperture homogeneously and independent from the field up to a filling degree of $\sigma = 0.6$, for example, the EUV-source must have the following 2-dim Lagrange optical invariant or *etendu*: (LC).

Page 4, line 4:

$LC_{ill.} = \sigma^2 LC_{Obj} =$ ~~0.149 mm$_2$ 0.928 mm^2~~ $0.149\ mm^2 - 0.928\ mm^2$

Page 4, paragraph starting at line 13:

The Etendu of a laser plasma source ~~can be roughly calculated~~is defined as the product of the illuminated surface of an imaginary unit sphere around the source and the square of the aperture angle at which each field point of the imaginary unit source sees the spherical source.

Page 4, line 19:

$A^{LPQ} = 2\pi[\cos(\theta_1)-\cos(\theta_2)] \times (R_{sphere})^2$, with $R_{sphere} = 1mm$

Page 4, line 20:

B

VERSION MARKED TO SHOW CHANGES MADE

~~NA ≈ r_{source}/1 mm = 0.100~~ NA ≈ r^{LPQ}/R_{sphere} = 0.100

Page 5, line 12:

$LC_{Pinch} = A \cdot NA^2 = (\pi \cdot 1\ mm^2 / 4) \cdot 0.3053^2 = 0.073\ mm^2$.

Page 9, paragraph starting at line 29:

Regarding the basic layout of EUV-illumination systems, we refer to the applicant's pending applications EP 99 1 06348.8, submitted on March 2, 1999, entitled "Illumination system, especially for EUV-lithography", US Serial No. 09/305,017, submitted on May 4, 1999, entitled "Illumination system particularly for EUV-lithography", now US Patent No. 6,198,793 B1, and PCT/EP 99/02999, submitted on May 4, 1999, entitled "Illumination system, especially for EUV-lithography", whose disclosure contents are incorporated in their entirety in the present application.

IN THE CLAIMS

Please amend the claims below to read as indicated herein.

38. ~~Illumination system for wavelengths ≤ 193 nm,~~(Amended) An illumination system, comprising:

a plurality of primary light ~~sources;~~ sources having wavelengths ≤ 193 nm; and

an optical unit for combining said plurality of primary light ~~sources; and~~ sources, said optical unit having a first plurality of raster elements for transforming said plurality of primary light sources into a plurality of secondary light sources,

wherein each of said first plurality of raster elements is reflective and is imaged into a plane ~~whereby~~to form one of a plurality of images ~~is formed~~.

VERSION MARKED TO SHOW CHANGES MADE

42. (Amended) The illumination system of claim 38, wherein each of said first plurality of raster elements is arranged and oriented to superimpose said plurality of images in said plane ~~forming~~to form an illuminated field.

43. (Amended) The illumination system of claim ~~42,~~ 42,

wherein said optical unit ~~has a shape of a pyramid with~~comprises a structure having a plurality of ~~sides,~~ sides,

wherein each of said plurality of sides corresponds to one of said plurality of primary light sources, ~~and~~ and

wherein said first plurality of raster elements is arranged on said plurality of sides.

45. (Amended) The illumination system of claim 38, ~~further comprising~~wherein said optical unit further comprises a second plurality of raster elements.

46. (Amended) The illumination system of claim 45,

~~whereinsaid second plurality of raster elements is located at said plurality of secondary light sources,~~

wherein each of said plurality of secondary light sources is located on one of said second plurality of raster elements, and

wherein each of said first plurality of raster elements and each of said second plurality of raster elements ~~is arranged and oriented to superimpose~~superimposes said plurality of images in said plane ~~forming~~to form an illuminated field.

48. (Amended) The illumination system of claim ~~47,~~ 47,

wherein said optical unit ~~has a shape of a pyramid with~~comprises a structure having a plurality of ~~sides,~~ sides,

wherein each of said plurality of sides corresponds to one of said plurality of primary light sources, ~~and~~ and

VERSION MARKED TO SHOW CHANGES MADE

wherein said second plurality of raster elements is arranged on said plurality of sides.

49. (Amended) The illumination system of claim 48, wherein each of said plurality of sides ~~is oriented to superimpose~~superimposes said plurality of images in said plane ~~forming~~to form an illuminated field.

50. (Amended) The illumination system of claim ~~46,~~ 46,
wherein said optical unit comprises a plurality of ~~pyramids,~~ structures,
wherein each of said plurality of ~~pyramids~~structures has a plurality of ~~sides,~~ sides,
wherein each of said plurality of sides corresponds to one of said plurality of primary light sources, ~~and~~ and
wherein each of said second plurality of raster elements is arranged on one of said plurality of sides ~~of said plurality of pyramids~~.

51. (Amended) The illumination system of claim 50, wherein each of said plurality of sides~~of said plurality of pyramids is oriented to superimpose~~ superimposes said plurality of images in said plane ~~forming~~to form an illuminated field.

56. (Amended) The illumination system of claim ~~54,~~46, wherein each of said second plurality of raster elements has a planar surface.

58. ~~An EUV projection~~(Amended) A projection exposure system comprising:
the illumination system of claim 38;
a mask located in said plane;
a projection objective lens; and
a light-sensitive object on a carrier system, wherein an image of said mask is formed on said light-sensitive object.

VERSION MARKED TO SHOW CHANGES MADE

59. (Amended) A method for production of microelectronic components, comprising the step of using said ~~EUV~~-projection exposure system of claim 58.